

CLAIMS:

[C1] 1. A micro component system for producing a syn-gas enriched with hydrogen from hydrocarbon compositions and water comprising:

a mixer for producing a feed stock of vaporized hydrocarbons and water vapor, a steam reformer into which the feed stock is directed, a combustor for generating heat energy from fuel cell off gas and vaporized hydrocarbons to heat the steam reformer, and an exit from the steam reformer for the syn-gas produced therein, including means for providing in at least one of the stages in the system a laminar flow of fluid to effect an energy exchange between fluids.

[C2] 2. A micro component power source in accordance with claim 1 in which a gas enriched with hydrogen is produced from hydrocarbon compositions and water comprising, interconnected in a cycle:

a fuel cell that consumes hydrogen and exhausts an off gas containing hydrogen;

a combustor for burning the fuel cell off gas to provide a source of heat energy;

a heat exchanger interconnected with the source of heat energy for transferring heat to a steam reformer;

a means for introducing hydrocarbon compositions and water from a source into the cycle;

a steam reformer for receiving a mixture of hydrocarbon compositions and water and catalytically reforming the mixture into a gas enriched with hydrogen; and

a flow path between the steam reformer and the fuel cell for introducing the gas enriched with hydrogen into the fuel cell.

[C3] 3. The device of claim 1 or claim 2 in which a heat exchanger directs fluids between which heat is exchanged into adjacent laminar flows.

[C4] 4. The device of claim 1 or claim 2 in which the means for providing laminar flow includes a catalytically active surface in contact with fluid flow.

[C5] 5. The system of claim 2 including a second heat exchanger for cooling the gas from the steam reformer, a water gas shift reactor and a preferential oxidation reactor, whereby a gas predominantly comprised of hydrogen is introduced into the fuel cell.

[C6] 6. The system of claim 5 including one or more storage tanks for separately storing at least one of fuel cell off gas, a liquid hydrocarbon composition and water.

[C7] 7. The system of claim 2 including an in-line Zeolite cracker.

[C8] 8. The system of claim 1 or claim 2 or claim 5 or claim 6 or claim 7 in operative combination with a fuel cell.

[C9] 9. The system of claim 2 including a start module comprising a heat exchanger with adjacent sections for laminar flow in which hydrogen from an external source is combusted to provide heat energy in one section and hydrocarbon fluids are vaporized in an adjacent section to initiate the vaporization of fluids and steam reforming in the system.

[C10] 10. A cycle useful in a micro component assembly for powering for a fuel cell comprising:

combusting a gas mixture including a hydrogen component to heat at least one vaporizer and a steam reformer;

providing a vaporized hydrocarbon and water mixture and introducing the mixture into the steam reformer to produce a feed gas;

cooling the feed gas and introducing the feed gas into a hydrogen fuel cell; and

combusting the off gas from the fuel cell to heat the vaporizer and steam reformer.

[C11] 11. An incrementally scalable power source in accordance with claim 1 in which scalable power increments of a predetermined magnitude are determined by the capacity of a laminar flow unit.

[C12] 12. The device of claim 11 in which the laminar flow unit is a micro channel having a width to depth aspect ratio of from about 1:10 to about 1:100.